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REVIEWS.

SUMMARIES OF THE LITERATURE OF STRUCTURAL MATERIALS. III.

EDWIN C. ECKEL.

ARMSTRONG, L. K. *Portland and Natural Cements of the Pacific Northwest.* Mining, Vol. IX, pp. 134–41, 1902.

Description of the materials and plant of the Pacific Portland Cement Co. The plant is located fifty miles from Newport, Wash., and a mixture of clays, shales, and limestone is used. Analyses of materials and product are given.

BAKER, I. O. *A Study of Road-Building Gravels.* Engineering News, Vol. XLVIII, pp. 345–8, 1902.

Detailed discussion, by a leading engineering authority, of a fresh subject. The requisites of a road gravel are: (1) the fragments should be so hard and tough as not easily to be ground into dust by the impact of wheels and hoofs; (2) the pebbles should be of different sizes, each in the proper proportion; and (3) there should be intermixed with the coarser particles some material which will cement and bind the whole into a solid mass. These requisites are separately discussed at some length, and eight typical and well-known road gravels are described.

BROWN, C. C., *editor. Directory of American Cement Industries and Hand-Book for Cement Users.* 2d ed. 8vo, pp. 740. Price, $5. Municipal Engineering Co., Indianapolis, Ind., 1902.

A second (revised and enlarged) edition of this valuable work first published in 1901.

A chapter on cement-testing gives, in addition to the methods adopted by the American Society of Civil Engineers, the recent reports of the Board of Engineer Officers (U. S. A.), on "Testing of Hydraulic Cements," and of the committee on methods of cement analysis appointed by the New York section of the Society of Chemical Industry. In the second chapter, dealing with cement specifications, samples are given of specifications in use by the War and Navy Departments, the New York Central, Pennsylvania, and Philadelphia & Reading railroads, and the public-works departments of several cities. Under the head of uses of cement are given data on the methods and costs of mixing concrete-and-steel construction, cement pipes, concrete blocks, etc. A long chapter on specifications for the use of cement quotes various specifications covering most of the uses to which cement or concrete may be put. Data on which to base estimates on cement work are given in detail. Several typical laboratories for cement-testing are described. The technology of lime and plaster is discussed more briefly. A large number of typical plants, manufacturing Portland, puzzolan, or natural cements, is described.

Following these valuable contributions to the general subject of cements comes the directory proper. This contains lists of American cement manufacturers; cement brands; sales agents; foreign cement manufacturers; dealers in cement; contractors, engineers, and other large users of cement; cement-testing laboratories; manufacturers of cement machinery; manufacturers of lime; plaster plants; and dealers in lime and plaster.

CLARKE, F. W. *Analyses of Rocks, Laboratory of the U. S. Geological Survey, 1880 to 1899.* Bull. 168, U. S. G. S. 8vo, pp. 308, 1900.

Contains many analyses of building stone and other material of economic interest.

COONS, A. T. *The Stone Industry in 1901.* Extract from Mineral Resources U. S. for 1901. 8vo, pp. 67, 1902.

The value of the stone produced in the United States during 1901 is given as $56,615,926. This total includes granite, $14,266,104; trap, $1,710,857; marble, $4,965,699; limestone, $21,747,061; slate, $4,787,525; sandstone, $6,974,199; and bluestone, $1,164,481.

CUMMINGS, URIAH. *[Production of] American Rock Cement [in the U. S. during 1900].* Mineral Resources U. S. for 1900. Pp. 745, 746, 1901.

Résumé of the condition of the American natural cement industry during 1900, with statistics of production.

DAVIS, C. A. *A Contribution to the Natural History of Marl.* Journ. Geol., Vol. VIII, pp. 485–97, 1900.

The influence of lower forms of plant life upon the formation of siliceous sinter, calcareous tuffs, etc., in the neighborhood of hot and mineral springs has been discussed by Weed and Cohn. In the present paper the relation of certain low plant forms to the formation of marl is treated in detail, special attention being given to marl deposits of the type commonly found in Michigan.

The Michigan marl (excluding its contained vegetable matter) is, undoubtedly, derived ultimately from glacial clays and disintegrated rock masses. These clays are rich in finely divided limestones, and in rock-forming minerals containing calcium compounds. Percolating waters, carrying carbon dioxide in solution, readily take up the calcium salts, to a certain limit. If the amount of carbon dioxide contained in the water be considerable, part of it will escape whenever the pressure is lowered. This should result in the precipitation of a corresponding part of the calcium carbonate. As the streams of the area under consideration do not deposit marl where they reach the surface, and as the waters of those springs and streams show no milkiness on exposure to ordinary atmospheric pressures and temperatures, it is inferred that no large amount of carbon dioxide is carried, and that there is no approach to the saturation point for calcium bicarbonate in the springs and streams of the Michigan marl region.

Three alternatives are therefore left: (1) the marl was formed under conditions differing from those at present; (2) the amount of dissolved salts is so small that the saturation point is not approached until after the lakes are reached and the slow evaporation and reduction in the amount of dissolved carbon dioxide brings about deposition of the lime carbonate; or, (3) animal or vegetable agencies, or both, cause the deposition of the marl.

The writer disposes of the first two possibilities, stating that the marl is formed at and below the present water level, even coating pebbles and living shells; and that the outlets of the marl lakes of Michigan are so large that little, if any, concentration occurs in the lakes.

Molluscan and other invertebrate shells, in fragments of recognizable size, do not contribute largely to the deposits of commercial value; and it is improbable that wave action in these lakes has been sufficiently strong to reduce shells to powder or mud. The sole remaining possible cause, then, is plant action; and this the author discusses in detail.

All green plants absorb carbon dioxide and release oxygen. If the calcium salts are in excess in the water, and are held in solution by carbon dioxide, then the more or less complete abstraction of the carbon dioxide from the water near the plant will cause direct precipitation of lime carbonate upon the leaves and stems. If, however, only minute percentages of lime salts are present in the water, the precipitation of lime carbonate is accomplished, not by the abstraction of carbon dioxide, but through the agency of the oxygen released by the plant, according to the following equation:

$$CaH_2(CO_3)_2 + O = H_2O + CO_2 + O + CaCO_3 \; .$$

Not all plants are equally active agents. The algæ seem to be of the greatest importance in the formation of marl deposits, one group—the *Characae* or Stoneworts—being of particular importance. Professor Davis collected five stems, each about 60^{cm} long, of a species of *Chara;* these yielded 3.6504 grains of solid matter, the mineral portion of which carried 93.76 per cent. of lime carbonate, 2.93 per cent. of magnesium carbonate; 2.40 per cent. of silica and undetermined, and 0.89 per cent. of oxides of iron and aluminum. *Chara fragilis* seems so be the most active form in the Michigan marl region, but it is probable that close examination will reveal a number of allied species engaged in the same work.

Pebble-like masses of marl, characteristically ellipsoidal in shape and showing both radial and concentric structure, are attributed to the action of another alga, determined to be a species of *Zonotrichia.* Similar, if not identical, material has been described by Murray, who identified the alga as *Schizothrix fasciculata;* but comparison of these materials was not possible.

DAVIS, C. A. *Second Contribution to the Natural History of Marl.* Journ. Geol., Vol. IX, No. 6. September to October, 1901, pp. 491–506.

Continued investigation, along three distinct lines, confirms the writer's opinion that close relationship exists between certain algæ (especially *Chara*) and marl deposition.

A series of careful mechanical analyses of typical marls from various (Michigan) localities was made. In general, it is easily possible to recognize with a simple microscope the particles held by a hundred-mesh sieve as being *Chara* incrustations or *Schizothrix* concretions; and it is therefore evident that a large part of the samples are of demonstrable algal origin.

The milky appearance of certain lakes has been cited as evidence of the probable presence of calcium carbonate, precipitated from the water by loss of carbon dioxide or change of temperature on reaching the lakes. Experiments show, however, that this turbidity is probably caused by the stirring up of marl deposits by wave action.

Tests showed that a large amount of a soluble calcium salt, determined to be calcium succinate, was present in *Chara*, diffused through the cell sap of the plant. The method of formation of this salt is not at present explainable. It seems probable, however, that it accumulates in the cells until it attains a sufficient density to diffuse through the cell walls by osmosis. Outside the cells or in its passage through the walls, it is decomposed directly into the carbonate. This decomposition is effected possibly by oxidation of the succinic acid due to free oxygen given off by the plants, possibly by some substance in the cell walls, or, more probably, by some organic compounds in the water due to bacterial growth in the organic débris at the bottom of the mass of growing *Chara*.

ECKEL, E. C. *The Quarry Industry in Southeastern New York.* Twentieth Report New York State Geologist, pp. r. 141–r. 176, Pls. XLII–LXI, map, 1902.

Preliminary report on the quarry industry in the counties of New York, Queens, Westchester, Putnam, Dutchess, Rockland, and Orange. Detailed descriptions of formations and quarries are preceded by a summary of the structural and stratigraphic geology of the area.

ECKEL, E. C. *The Utilization of Iron and Steel Slags.* Extract from Mineral Resources U. S. for 1901. 8vo, pp. 17, 1902.

A fairly detailed discussion of the various methods of utilizing slags. In the present connection it is of interest to note that slags are used in the manufacture of Portland and natural cements, slag blocks, slag brick, and glass; and also as road metal and railroad ballast.

This paper was not printed in the completed volume of the *Mineral Resources* for 1901, and is therefore obtainable only in the form above cited.

FISHER, C. A. *Methods of Studying and Displaying Quarry Products as Employed by the University of Nebraska Geological Survey.* Proc. Nebraska Acad. Sci., Vol. VII, pp. 153–5, Pls. XI–XIII, 1901.

Brief description of the methods of gathering data regarding quarries, and of utilizing this information in the display of specimens.

GILLETTE, H. P. *The Cause of Masonry Disintegration.* Engineering News, Vol. XLVIII, pp. 340–42.

Discussion of masonry disintegration in high latitudes; with arguments tending to prove that this disintegration is due primarily, not to frost, but to alternate expansion and contraction attending changes of temperature. The paper cannot well be summarized, but is included here as being closely connected with the subject of the decay of building stone.

KIMBALL, L. L. *The Production of Cement in 1901.* Extract from Mineral Resources U. S. for 1901. 8vo, pp. 17, 1902.

During 1901, fifty-six plants produced 12,711,225 barrels of Portland cement, valued at $12,532,360. Natural cement was manufactured by sixty plants, the product being 7,084,823 barrels, valued at $3,056,278. Five plants are said to have produced 272,689 barrels of slag cement, valued at $198,151.

McCallie, S. W. *Some Notes on the Trap Dikes oj Georgia.* American Geologist. Vol. XXVII, pp. 133–4, Pls. XII–XIV, March, 1901.

Notes on the distribution and character of the trap dikes, which are possibly of Triassic age.

Middleton, J. *Statistics of the Clay-Working Industries in the United States in 1901.* Extract from Mineral Resources U. S. for 1901. 8vo, pp. 78, 1902.

The total value of clay products in the United States during 1901 was $110,211,587; the number of firms reporting being 6,421.

Newberry, S. B. *Fuel Consumption in Portland Cement Burning.* Reprinted July, 1901, from Cement and Engineering News. 8 pp.

Discussion of the theoretical and actual fuel requirements of the various types of kilns in use, and of the effects of the different methods of mixing the slurry.

Newberry, S. B. *[Production of] Portland Cement [in the U. S. during 1900].* Mineral Resources U. S. for 1900, pp. 737–44, 1901.

Résumé of condition of American Portland cement industry during 1900, with statistics of production. A discussion of fuel consumption is given, abstracted from the previous paper.

Parsons, A. L. *Recent Developments in the Gypsum Industry in New York State.* Twentieth Rep. N. Y. State Geologist, pp. r. 177–r. 183.

Descriptions of the gypsum deposits at Fayetteville, Union Springs, Marcellus, Mumford, and Oakfield; with notes on the technology of calcined plaster — the manufacture of which has recently become an established industry in the state.

Ries, H. *Occurrence of Glass-Pot Clays in the United States.* Extract from Mineral Resources U. S. for 1901. 8vo, pp. 17, 1900.

Glass-pot clays should be highly refractory, very plastic; dense burning, low in flexing constituents and silica, and high in tensile strength. These requisites are briefly discussed, and certain typical foreign pot-clays are described in detail. American pot-clays are derived from the Carboniferous of Pennsylvania and Missouri, occurring in close association with other refractory clays. Analyses and tests of a number of these domestic materials are given.

Ries, H. *The Production of Flint and Feldspar in 1901.* Extract from Mineral Resources U. S. for 1901. 8vo, pp. 9, 1902.

A quantity of 34,420 short tons of "flint" (quartz), valued at $149,297, was produced in the United States during 1901. This was mined in Maine, Massachusetts, Connecticut, New York, Pennsylvania, Maryland, and Wisconsin; and is largely utilized in potteries and in the manufacture of wood-fillers and scouring-soaps.

Feldspar was produced in Maine, Connecticut, New York, Pennsylvania, and Maryland, the total amount being 37,741 short tons, valued at $220,422. It is used in the manufacture of pottery, wood-fillers, scouring-soaps, and glass.

Russell, I. C. *The Portland Cement Industry in Michigan.* Twenty-second Ann. Rep. U. S. G. S., Part III, pp. 629–85.

Brief notes on the history of the Portland cement industry in Michigan and the general technology of Portland cement are followed by detailed discussions of the limestones, marls, shales, clays, gypsum, and fuel supplies of Michigan, in connection with the cement industry. Following these are notes on factories, processes, product, etc. The sections on materials will be summarized.

Limestones from two formations (Dundee and Traverse) have been used in making Portland cement, while other limestones may be so utilized in the future. The Dundee limestone occurs at the base of the Devonian, and contains at least one bed of sufficient purity to be used in Portland manufacture. Material from this bed is utilized by the Michigan Alkali Co. at Wyandotte. The limestones of the Traverse group (Devonian) are used in the manufacture of Portland cement at Alpena.

Certain Silurian limestones may furnish a natural cement, while Eo-Carboniferous limestones, not at present used in Portland cement manufacture, are sufficiently low in magnesia to be a possible future source of Portland material.

Marl deposits of great area and depth occur abundantly on the lower peninsula of Michigan. A map of this portion of the state showing the location of the best-known deposits and of actual and proposed Portland cement plants, is presented. Numerous analyses of Michigan marls are given, and their physical properties, chemical composition, and probable origin are discussed in detail; the conclusions of Davis as to origin being restated and carefully considered.

Shaes of the Traverse (Devonian) and Coldwater (Carboniferous) formations are used in Portland cement manufacture; the former at Alpena, the latter at Union City and Coldwater. The Antrim shales of the Devonian and the Saginaw shales of the Carboniferous, are referred to as of possible use.

The surface clays are, in general, too sandy to be of use in cement manufacture, though they have been so used at Wyandotte. Several Michigan cement plants obtain their clay from Ohio.

Most of the gypsum used in the Michigan cement plants is procured from the extensive deposits near Grand Rapids.

The coal used is mostly from Ohio and Pennsylvania, though Saginaw Valley coal has been used to a small extent.

During the year 1900 five Portland cement factories were in operation in Michigan, while several others were in course of construction. Of those in operation, four were equipped with rotary and one with dome kilns. As regards materials, two plants used marl and clay; two, marl and shale; while one plant used precipitated lime carbonate (caustic soda waste) and clay. Only one of the plants in construction is designed to use limestone and shale; the others using marl with clay or shale.

STRUTHERS, J. *The Production of Gypsum in 1901.* Extract from Mineral Resources U. S. for 1901. 8vo, pp. 13, 1902.

An amount of 659,659 short tons of gypsum, valued at $1,577,493, was produced in the United States during 1901. Of this amount, 521,292 tons were calcined, the remainder being largely used as land plaster.

TAFF, J. A. *Chalk of Southwestern Arkansas;* with Notes on its Adaptability to the Manufacture of Hydraulic Cements. Twenty-second Ann. Rep. U. S. G. S., Part III, pp. 687–742, Pls. XLVII–LIII, Figs. 57–69, 1902.

Descriptions of the general geography and geology of the region are followed by a detailed discussion of the two chalk-bearing formations, with local details of the available deposits. Following this is a summary of the technology of Portland cement; notes on the chalks (Taff) and clays (Branner) of southwest Arkansas as Portland cement materials; and a brief description of the Whitecliffs cement plant. The subjects are well arranged; and the section on cement technology is rather more satisfactory than the material usually offered under this heading.

The sandy basal member of the Upper Cretaceous, prominent in Texas and Indian Territory, is concealed throughout its extent in Arkansas by post-Cretaceous gravels and sands. The lowest member of the Upper Cretaceous visible in Arkansas is therefore the marl overlying this basal sandy member. This marl is a continuous formation, and increases gradually in thickness from 30 feet at Austin, Tex., to 300 feet at Whitecliffs, Ark. Overlying this marl is the Whitecliffs chalk, which in turn is overlain by 200 feet of blue limy marl. Above this is the Saratoga chalk, which is succeeded by greensands and clay marls. The Whitecliffs and Saratoga formations will now be discussed in some detail, as being possible sources of Portland cement materials.

The Whitecliffs chalk is exposed, in Arkansas, in three separate areas, being covered in the intervening regions by post-Cretaceous deposits. These areas are in the vicinity of Rocky Comfort, Whitecliffs, and Saline Landing. In the Rocky Comfort area the thickness of the formation could not be precisely determined, but probably exceeds 100 feet. Farther east, at Whitecliffs, nearly 100 feet of chalk is exposed, and the top of the formation is concealed. Still farther east, at Saline Landing, less than half this thickness is shown. At Okolona no chalk occurs, its stratigraphic position being occupied by a chalky marl. The Whitecliffs chalk therefore occurs as a wedge, thickest toward the west, and coming to an end near the middle of the Cretaceous region of southwest Arkansas.

The Saratoga chalk formation occurs 200 feet above the Whitecliffs formation, and separated from the latter by marls. The maximum thickness of the Saratoga chalk is 30 feet; it is exposed in three areas in Arkansas, located respectively at Washington, Okolona, and Deciper.

Analyses show that these chalks of both formations vary greatly in composition; the lime carbonate varying from 49.90 per cent. to 90.01 per cent.; the silica and insolubles, from 4.91 per cent. to 43.72 per cent. In one respect the specimens agree: they are all sufficiently low in magnesia to come well within Portland requirements.

WILDER, F. A. *Present and Future of the American Gypsum Industry.* Eng. & Min. Jour., Vol. LXXIV, pp. 276-8, 4 Figs., 1902.

Brief review of the origin and distribution, both geographical and geological, of gypsum deposits; followed by a somewhat more detailed discussion of the uses of gypsum and the methods of manufacture of the various gypsum products, with interesting notes on recent German practice in the manufacture of plasters.

Origin of the Oligocene and Miocene Deposits of the Great Plains.— By J. B. HATCHER. (Proc. Am. Phil. Soc., Vol. XLI. [April, 1902].)

AFTER an introductory statement regarding the various horizons of the Tertiary deposits of the western plains, the author proceeds to a